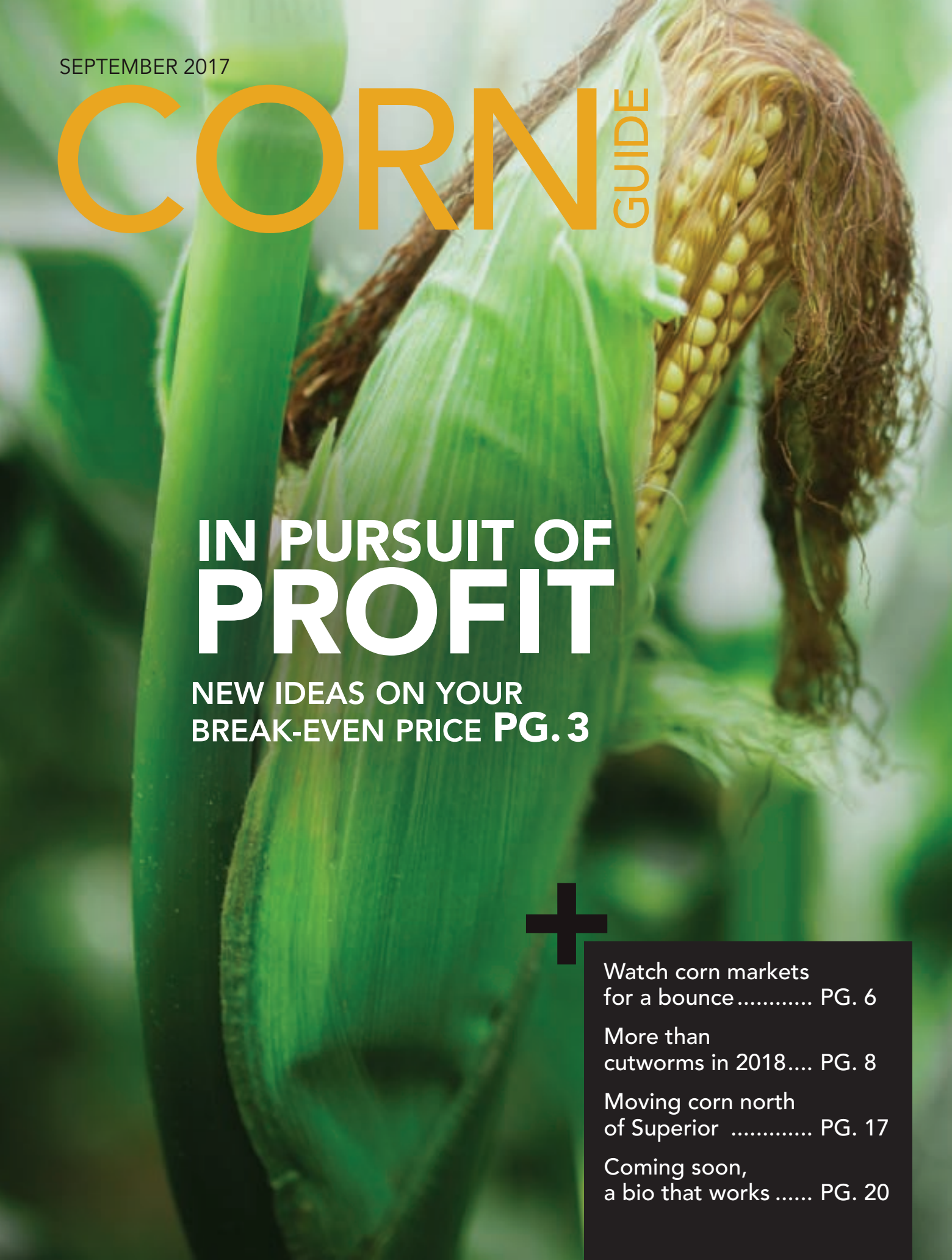
SEPTEMBER 2017

CORN GUIDE



IN PURSUIT OF PROFIT

NEW IDEAS ON YOUR BREAK-EVEN PRICE PG. 3

+

Watch corn markets for a bounce ..... PG. 6

More than cutworms in 2018.... PG. 8

Moving corn north of Superior ..... PG. 17

Coming soon, a bio that works ..... PG. 20

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BREAKING EVEN

What market price do you need to break even? The answer depends not just on your costs, but your goals

By Ralph Pearce, CG Production Editor

Every winter, talk turns to production costs, with a focus on how to get your break-even price even lower.

But what is your break-even?

Most of us believe it's a reasonably simple figure to calculate: just divide your yield by your expenses, including the cost of seed, fuel, fertilizer, herbicide and fungicide applications, a possible insecticide treatment, seed treatments, scouting, and any custom work done on a field.

Even if you stop there, the number can climb toward $5 a bushel.

For a better number, though, be sure to also include land costs, machinery overheads and your labour, plus insurance and related expenses.

And get ready to take some time to work it out. This is an exercise that is going to take some serious concentration. And it's also work you have to do for yourself. Not only are costs different from anyone else's, but so are your yields — which is critical.

THE DANGER OF "AVERAGES"

One of the great advances of the past 10 to 15 years in agriculture is the recognition that it can be dangerous to deal with averages. Yield expectations vary with heat units, soil types, drainage and so much more, confounding the quest for a one-size-fits-all cost of production.

Chad Anderson, an independent certified crop adviser (CCA) from Brigden, Ont., agrees that expectations and break-even pricing vary from grower to grower

Continued on page 4

The advent of precision ag systems is having — and will have — a significant impact on break-even calculations.

Continued from page 3

as well as field to field. And he emphasizes that growers need to have a strong handle on their cost structure (variable and fixed) in combination with realistic yield parameters if they're going to perform a realistic break-even analysis.

"Producers manage their input based upon yield potential, and this can be affected by previous crops, soil type, field drainage, or in a year like 2017, where even planting date influences decisions," says Anderson, noting the growing range of factors affecting break-even. "Yield is the most influential factor in break-even costing, as it's the main divisor. I know of some producers who use multiple scenarios with yield: they'll use their crop insurance average, their crop insurance guarantee and a higher yield — a kind of 'good, bad and the ugly,' if you will."

Obviously the break-even figure will change across these forecasts, even if costs stay the same over all three levels.

Other growers will look at different yield goals based upon yield potential of the different fields, keeping previous crops, drainage and soil types in mind.

Then there's the difference that a livestock or poultry producer brings to the picture. A livestock producer might only put manure on fields that are close to their livestock facilities. Those will have an inherent higher yield potential with a lower input requirement, leading to a more favourable break-even than other areas of their own farm operation, so those who do have access to manure obviously have another set of parameters to enter into the calculations.

As farming becomes more intense and more technologically advanced, the factors that might influence cost of production or break-even pricing also evolve. Dr. Dave Hooker brings a pair of considerations to costing assessments: the impact of previous crops and the ever-growing effect of precision ag. As a field crop agronomist and associate professor at University of Guelph's Ridgetown Campus, Hooker has been involved with Dr. Bill Deen, an associate professor, also with the University of Guelph, in long-term studies on the impacts of rotation.

"We have been reminding growers of our long-term rotation data that shows wheat in the rotation increases corn and soybean yields, and enables the inclusion of red clover, which can also increase corn yield and reduce N requirements," says Hooker. "However, the vast majority of growers do not give wheat this credit, which results in a biased break-even for wheat (a higher break-even than actual) versus corn and soybean. Without considering the systems approach on crop performance, the real break-evens for corn and soybean are higher than they first appear without wheat in the rotation, because corn and soybean yields would be lower and the cost of nitrogen for corn higher."

Hooker acknowledges a constant friendly debate he's had with ag economist Phil Shaw, who farms in nearby Dresden, Ont. Shaw stresses the picture of success is always based on economics and less on yield. Yet Hooker insists that growers need an accurate yield response for "product or treatment X" — and how variable the response can be, which is what he strives to provide.

At that point, growers can simply plug this number into their own farm-specific financials.

Hooker also sees technology causing significant changes in the ratio of costs to break-even prices. Growers who use precision ag systems like variable rate technology, field data and software to enable the generation of prescription maps will influence their bottom line.

"The cost of production (COP) and break-even varies from grower to grower, field to field and year to year," says Hooker, echoing Anderson's observation. "Even within a field — from a precision ag perspective, COP also depends on whether the land is rented or owned, the pest pressures present — and whether more dollars are needed to control herbicide-resistant weeds versus fields with low weed pressure or fewer herbicide-resistant weeds."

Also a factor is whether controls are needed to suppress soybean aphid or Western bean cutworm."

Again, echoing Anderson's assessment, Hooker says the break-even price will depend on determining the effects of fixed costs versus variable costs. From a marketing perspective, he also believes the break-even price is important for establishing a marketing plan and callibrating it year-to-year.

YIELD MAKES THE DIFFERENCE

In a region where the phrase "Corn is King" is still an accurate description, Greg Stewart concedes that a grower knowing their cost of production may be essential, but not knowing it doesn't exactly put them in a class by themselves.

Calculating break-even corn prices is probably as challenging as other aspects of crop production, and sometimes it can seem so difficult, it's better just to skip it.

"I would assume most growers are content with doing some specific input-return calculations — as in 'fungicide cost me $23 and I got six bushels more' — was it worth it?" says Stewart, agronomy lead with Maizex Seeds. He also cites the 2017 OMAFRA budget to help with calculations. "Costs (from the budget) are at $558.20 per acre, so at 150 bu./ac. yield, that needs $3.72 per bushel to break even. At 200 bu./ac., that needs $2.79."

Ridgetown's Dave Hooker hopes to see precision maps that divide each field into cost zones.

Calculating your break-even cost is as challenging as any field job. And according to Stewart, it's just as valuable

That's a big difference, Stewart says, especially when those figures do not include land costs.

Stewart also believes that little has been done to incorporate the value of precision ag, taking Hooker's statement a few steps further. For all of the precision ag talks that he's attended, he doesn't remember anyone showing a break-even analysis on a precision ag map. He sees all kinds of yield maps and prescription maps, as if to say, "This is how we put the nitrogen down, this is how we put the potash down, this is where we up the population, this is where we drop the population."

"When you think about it, we have some significant measuring skills, and now you're doing some things to change your input costs," says Stewart. "If we're going to cut back on nitrogen or seed, it'd be really interesting to look at that map and see what it looks like in terms of break-even."

In an ideal world, a grower should be able to see those areas of a field where they can never break even, such as a sandy knoll where the break-even cost is $7 or $8 a bushel. Stewart believes it should be possible to create a break-even map of those sections, identify where they are, and take them out of production, planting switchgrass or miscanthus and leaving it there. You wouldn't make any money on that section or sections, but you wouldn't lose as much, either.

"It captures this idea that in a precision ag world, our break-even costs should be quite intriguing, and what's my break-even costs on those spots in a field, and can I do something to improve that?" says Stewart. "By improving the yield or dropping the input costs, and maybe at an extreme point, if a grower looks at a break-even map and it's always $7.50 for that section, then those are spots in the field that I'm losing money on all of the time."

ON-FARM STORAGE

Another of the hidden costs often lost in the shuffle is on-farm storage. For Anderson, this should be treated as a fixed cost across all of a farm's crops. A grower will have to service the debt attached to on-farm storage, regardless of what crop goes in, and your financial institution will still want the grain dryer payment whether a crop was dried or not.

"On-farm drying and storage does provide some competitive advantages in terms of break-even since, hopefully, the system you have can dry corn for less than what a commercial elevator will charge," says Anderson. "On-farm also makes staying the course with your rotation a bit easier as you can always put the crop away and hope your loss-leader crop price improves in time versus someone who ships everything at harvest, and will be forced to deal with storage charges or brokerage fees, making the planting-time decision more restrictive in terms of pricing options."

Ideally, a producer can make an acceptable profit in every crop they have in their desired rotation, says Anderson.

As crop prices have fallen, however, growers and their advisers are forced to look at budgets more intently. In the end, though, a grower still has to deal with some harsh realities that can't be controlled: heavy clay soils with poor drainage probably won't allow for too high a corn yield. But, then, farming on some sharp sand probably means wheat is out of the question as well. Crop rotations aren't always the easiest things to maintain today.

Again, this isn't a business for the faint of heart. **CG**

Sometimes it seems prices are stuck in neutral. But keep your eyes open. Global demand is enormous, and shocks can emerge overnight

Watch those corn prices

By Philip Shaw

Corn is a brilliant crop to grow. Its productivity is amazing, with a planting season here in North America that starts in February in Texas and ends in June somewhere in Canada.

With genetics that fight off all kinds of pests, it's almost like there's an explosion in the field as the crop heads into tassel and it shows its full, insatiable drive to give farmers top yield.

Weather can be the great equalizer, as we saw in 2012 when drought impacted the crop in the U.S. However, at the end of the day, for many farmers, corn remains a favourite crop to grow.

The 2017 growing season in the U.S. has been uneven. In the northwest plains of the Dakotas, severe dryness had an impact on crops through early summer. This drought boosted wheat prices, but also had a negative impact on corn potential in that area. In the eastern and mid-southern U.S. corn belt, meanwhile, spring weather was much wetter and caused planting delays.

As the crop entered the summer, hot and dry forecasts continued to challenge the crop on many levels. However, in mid-July the forecast changed to a cooler forecast, taking some of the pressure off.

Needless to say, the USDA, as of early August 2017, was still projecting a U.S. national corn yield of 170.7 bu./ac. on 90.9 million acres planted. Private forecasts, by contrast, ranged from 170 down to 162 bu./ac.

Getting here in 2017 has been a bit of an adventure. New crop soybean prices held steady during the winter months of 2016/17 presenting a pricing scenario that seemed much more profitable than corn at the time. Many analysts had predicted that U.S. soybean acres might outstrip U.S. corn acres for the first time in many years. However, although that did not happen, the 2017 corn acreage did fall 3.1 million acres from last year, and soybean acreage was up seven per cent.

With this reduction in U.S. corn acres as a backdrop, it might have seemed reasonable that higher corn prices might be in the offing for 2017 and 2018. However, that has not been the case. In fact, since the start of 2017, spot corn prices south of the border have been reflective of a market that is satisfied with both supply and demand.

But 2017 can make us more confident that there will be increased futures prices ahead.

Part of the issue holding back corn prices in 2017 is the onerous old-crop situation in the U.S. Even going into mid-August, the old-crop ending stocks left over from last year were projected at 2.370 billion bushels. This is with a stocks-to-use ratio currently at 16.3 per cent.

The projected ending stocks for 2017-18 are 2.325 billion bushels based on a production this year of 14.255 billion bushels. The new-crop ending stocks to use ratio is 16.2 per cent. Simply put, it is a very bearish supply-sided old-crop corn scenario, and it is weighing on new-crop price potential. It is one of the main reasons why the corn futures price is so range bound.

With those numbers, it is easy to have your eyes glaze over. What's the point of even watching the market? However, there are glimmers of hope and there are rays of light within the corn complex, which may offer marketing opportunities in the future.

Corn demand is one of them. For the corn growing in the field now, projected demand is 14.350 billion bushels. This is an incredible figure and it requires U.S. production levels to be maintained on an annual basis. Feed demand is projected at 5.475 billion bushels (bbu), and ethanol production is projected at 5.5 bbu.

Yes, the market fundamentals present a generally bearish picture. However, at the same time the demand numbers are so dynamic that it would only take a small production shortfall in the U.S. to

Placing standing cash price orders may be a wise move in a corn market that may yet see some bounces because of USDA reports and international events

send prices much higher and force demand to be rationed.

But when will that production shortfall come?

It does not look like it is on the horizon in 2017, but it will eventually be here. Farmers should not lose hold of that reality, even though at times it feels like bearishness in corn will last forever.

In Canada, meanwhile, the great challenge for corn growers is to co-ordinate the two layers of crop marketing strategy. Specifically, we have basis risk, and we have futures risk. They are separate, and need to be addressed as separate.

In Ontario, for instance, there are historical patterns to the corn basis which, if watched carefully, can be rewarding. Typically, Ontario does not produce as much corn as we need, but a supply or delivery glut often leads to a very low basis level at harvest. In fact, corn is usually exported to the U.S. in the late fall and winter, and sometimes imported back into summer with a corresponding higher import basis.

This corn basis situation differs across regions of the province, however, as well as into Quebec. Generally speaking as you move east, the corn basis is higher. In fact, in Quebec, flat pricing is king. This is a constantly changing cash price situation, to some extent governed by the Canadian dollar, but also by the demand for corn in that particular area and by the proximity of neighbouring U.S. replacement corn supplies. This cash price equation for Ontario and Quebec cannot be ignored. Sometimes basis fluctuations can trump futures moves in corn. It will be a continuing challenge for eastern Canadian corn growers into late 2017 and early 2018.

The new-crop cash elevator price for corn in southwestern Ontario in early August 2017 settled at approximately $4.40 a bushel. The old-crop price for any corn still in the bin was approximately $4.25 a bushel, with prices about 50 cents higher in eastern Ontario. These prices are reflective of ample supplies in Ontario as well as a Canadian dollar which rose to 80 U.S. cents from the 72 U.S. cents level on May 2, 2017.

The U.S. replacement price for corn was approximately $4.92 in early August. It is a classic Ontario market situation, where ample supplies are keeping the cash prices down.

Successive USDA reports going into January 2018 will help define U.S. total corn supply for this year and next. These USDA reports serve as flashpoints in the corn market as speculators embrace USDA data. The USDA had predicted 170.7 bu./ac. corn crop earlier in 2017, but we will see how well this holds up as we get into harvest, with the final yield report due in January 2018. Corn producers need to be aware of these reports as they always have a significant effect on corn futures prices.

There are a myriad of market factors at play that still could affect corn prices. Brazil and Ukraine corn production continues to expand and challenge U.S. export markets, especially at certain times of year. Geopolitical events can also disrupt markets. There is always the prospect of a "black swan" event (unexpected sudden major event), which could impact corn prices higher or lower.

Standing cash corn market orders can be a good tool to use in this corn market environment to sell grain.

Corn might be a brilliant crop to grow, standing tall and handsome, but the corn market has a life of its own. The challenge for farmers is to immerse themselves in the various market factors. Daily market intelligence will always be key. **CG**

More than cutworms

Pests in 2017 have been a more complicated picture, based largely on a mixed bag of weather-related challenges

By Ralph Pearce, CG Production Editor

Coming out of winter and looking ahead to any growing season, it's impossible to predict which insect pests will be the biggest challenge for growers. In 2001, for instance, soybean aphids first became a widespread issue for Ontario farmers, and the fear took such firm root that we'd have to deal with them in 2002 that the reality fell short of the expectation, leading to the incorrect assumption that aphids would be an "every-other-year" pest.

For the past two years, Western bean cutworm (WBC) has become a focal point for farmers, agronomists, extension personnel, retailers and researchers. In the U.S., farm media reports were urging growers to use increased diligence in steeling against its impacts, even as Canadian farmers waited for their fields to dry out and warm up.

In spite of increased awareness and calls for increased scouting, the one truism about insect problems is that a pest will be a problem when it becomes a problem. For much of the early part of the 2017 growing season, most agronomists, advisers and ministry personnel took more of a wait-and-see approach, yet with corresponding words of caution.

> "If anything does have us at a bit of disadvantage, it's that the crops got in a little later."
>
> — Tracey Baute, OMAFRA

Spraying is warranted if there's an accumulation of five per cent of plants with eggs or small larvae, according to OMAFRA recommendations.

Tracey Baute, field crop entomologist with the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), took a proactive step on May 10, issuing a fact sheet on WBC titled "How to prepare for 2017." She noted that WBC "has earned the designation of primary pest of corn in Ontario, and it is starting to become important for dry bean growers, too." She also co-authored a fact sheet ("Western bean cutworm scouting and management in field corn") with Jocelyn Smith and Art Schaafsma, both of the University of Guelph Ridgetown Campus.

But 2017, with its heavy rains interspersed with patchy dry regions, has been an ideal environment for almost every pest, notes Baute, with some regions seeing species that under normal circumstances, a farmer might not worry about.

"If anything does have us at a bit of disadvantage, it's that the crops got in a little later," she adds. "That can set us up for certain insects to build up their populations and hang out in fields longer before the crops are harvested. That said, weather will play a big role as to whether they have an impact."

APPEARANCES CAN BE DECEIVING

During the first half of July, Twitter came alive with reports, photos and posts pertaining to WBC activity and counts. In one week (July 10 to 17), trap-counts in southwestern Oxford County skyrocketed, from 55 collected near the hamlet of Cultus to 366 seven days later. During the same period, a farm near Walsingham jumped from 71 on the 10th to 263 on the 17th.

Granted, these numbers were from one small corner of one county, but this certainly wasn't the only part of the region to see more activity.

PHOTOGRAPHY: AARON STEVANUS, PRIDE SEEDS

In spite of those higher counts, Baute reminds growers that there's more to determining the severity of pests or their potential for damage. In her "How to prepare for 2017" document, she noted that it's the action threshold that is the key factor to determine whether to spray or not. For starters, thresholds are not based on trap counts, since only the males are caught in traps, leaving the females free to lay eggs.

"Spray is warranted if there has been an accumulation of five per cent of the plants with eggs or small larvae," states Baute's document. "If during Scouting Trip 1, there were two per cent of the plants with eggs on them, and four days later during Scouting Trip 2, there are three per cent, then there's a need to spray."

Regardless of rising trap numbers, Baute says scouting is the real key. For the 2017 growing season, she advised all growers to scout all corn hybrids, including those containing Bt technology. Those hybrids with the *Cry1F* gene are no longer effective against WBC. Even those with Viptera technology should be scouted to confirm the Bt trait is still effective.

John Seliga, an agronomist for DuPont Pioneer, echoes many of Baute's observations, including her advice about scouting for WBC. He also has been active on Twitter, posting photos of egg masses and tips on how to use sunlight and shading to find them. In his area along the Lake Erie shoreline, he's hearing of WBC trap counts as high as 300 in a week. That's why he also advocates scouting as one method of monitoring, and yes, the *Cry1F* genetic trait is less effective.

"Hybrids containing Viptera technology still benefit from very good protection to this pest, though there are relatively few options available for growers today," says Seliga. "With regards to scouting, I believe what the Corn Pest Coalition group has set up is a highly effective network of Western bean cutworm traps for Ontario producers. It's critical to monitor moth flights to accurately predict when field scouting should occur."

With proper scouting, growers and their agronomists can better plan an effective insecticide management strategy to control WBC and protect the corn crop from both yield and quality losses, Seliga adds.

Seed dealers, agronomists and advisers are very vocal in 2017 about scouting for Western bean cutworm egg masses.

"It's critical to monitor moth flights to accurately predict when field scouting should occur."
— John Seliga, DuPont Pioneer

OTHER PESTS IN THE MIX

One of the drawbacks of paying particular attention to one pest is that others might escape notice — although to be fair, increased scouting should limit that potential. Drew Thompson, market development agronomist with Pride Seeds, says soil insects are at extremely high levels in 2017, including grubs, wireworms and seed corn maggot, among others. Increases in the grubs and wireworms suggest a link to recent mild winters, along with low winter mortality rates. Why seed corn maggot is a problem is something that needs answering, yet it's the worst Thompson has seen.

"Cover crops definitely hurt," says Thompson, adding that early pest pressures were varied. "Slugs and millipedes were bad, some soybeans needed to be replanted as a result of slug pressure. Bean leaf beetle was found in the Niagara area, and some guys did end up spraying."

That's the first of bean leaf beetle in Niagara that Thompson has witnessed, but in talking to other agronomists from the region, the pests are not unheard of in that area. Black cutworm was also quite common, and armyworm was patchy, although some wheat and corn fields required early control.

Baute and Seliga also note an increase in other pests, particularly soybean aphids. Baute mentions that some growers she's talked with were shocked to find them as early as June.

"They've forgotten that it's very normal to find them starting colonies anywhere east and north of London," says Baute. "It by no means indicates that this year will be a problem year."

For Seliga, 2017 will be known as the year that growers had to deal with above-average pest pressures for below-ground insects that are a concern at the seedling stage. It's still too early know the total rootworm damage.

The U.S. Corn Belt has reported finding the pest, and there had been sporadic reports in Ontario. But Seliga believes longer rotations are a boon to growers in Eastern Canada, and should help control corn rootworm from establishing with the same intensity. **CG**

PRAIRIE CORN: AGRONOMICS AND ECONOMICS

A four-year project in Manitoba has some notable findings on tillage economics and the reliability of heat unit ratings

By Angela Lovell

As Prairie farmers consider growing some of the shorter-season corn hybrids coming onto the market, they still have questions whether they should even risk trying them, and which hybrids have the best chance of success.

After completing three years of the four-year Corn Agronomy Project, researchers are beginning to provide a few answers — and more questions.

The Manitoba Corn Growers Association is co-funding the project along with the Western Grains Research Foundation and Growing Forward II. The project focuses on four key areas — crop rotation and phosphorus fertility strategies, residue management, row spacing and evaluating the corn heat unit (CHU) model for Western Canada.

"The project is meant to complement the work that's being done in the private sector to breed and select for early maturity corn that's adapted to Western Canada," says principal researcher Yvonne Lawley of the University of Manitoba. "It recognizes that farmers need good information about how to incorporate corn into their production systems and crop rotations."

Researcher Magda Rogalsky stands in an unfertilized check plot with a field of canola in the background. Studying the relationship between corn and canola, which is non-mycorrhizal, is part of the four-year Corn Agronomy Project.

PHOTO: DON FLATEN

CORN AFTER CANOLA

Researchers are giving special attention to how corn fits with canola, as there is little information about how they perform together. Most corn research has come out of Eastern Canada and the U.S., where corn, soybeans and wheat are the most common rotation.

Canola is non-mycorrhizal, meaning it doesn't depend on soil fungi. But corn is highly dependent on mycorrhizae, especially for early-season phosphorus uptake.

"Studies elsewhere have shown a big challenge with early-season plant growth and uptake of P when corn was grown after canola," says Don Flaten of the University of Manitoba, who leads the corn fertilization study. "We are looking at whether placing some P fertilizer and zinc fertilizer close to the seed row would help."

In the trials, corn followed either canola or soybeans. The corn received five starter P treatments, side-banded at planting. Treatment 1 was the control, with no starter P. Other treatments were 27 lbs. P2O5/acre and 54 lbs. P2O5/acre and the same rates applied as MAP (monoammonium phosphate, 11-52-0) or with MicroEssentials SZ (12-40-0-10-1) zinc. (Some studies have shown that corn on canola stubble may be prone to zinc deficiency but these trials didn't show any response to starter zinc, most likely because test sites were not deficient).

"With the application of starter P, we saw substantial increases in early-season growth — in some cases twice as much — than the control that received no P, especially when corn followed canola," says former master's student Magda Rogalsky, who worked on the project.

"Once we got to silking and pollen shed, we saw further maturity differences. In some cases, the control was three to seven days behind the starter P treatment plots. So we had advanced maturity with the application of starter P, regardless of the preceding crop."

Flaten says starter fertilizer may allow planting of a higher-yielding, longer-season corn hybrid. "Or if producers want to reduce their risk, they would be able to harvest a shorter-season hybrid three to seven days earlier."

Corn grain moisture decreased by up to three per cent when starter P was applied on corn following canola. Rogalsky says this reduces the need for drying capacity and allows an earlier harvest, potentially avoiding poor field conditions.

Corn grain yield increased by 11 bu./ac. with the highest rate of MAP compared to the control, regardless of the preceding crop.

> "For an average size farm in Manitoba (around 1,100 acres) strip till could save a farmer approximately $11,800 to $14,600 per year compared to other tillage systems."
>
> — Patrick Walther, University of Manitoba

ECONOMICS OF CORN IN ROTATION

Manitoba crop insurance crop rotation data shows that corn yields well after soybeans, but the researchers are also using the data to see if the agronomics and economics match.

Corn/soybean/corn/soybean definitely comes out as the most profitable rotation so far, says University of Manitoba agricultural economics professor Derek Brewin, based on a model that compares average provincial crop yields with current crop prices.

But before farmers rush into a corn/soybean rotation, there are a few caveats. It's still risky to grow corn and soybeans in certain areas of Western Canada given the short growing season and weather variability. Continuous soybean/corn rotations aren't the best from the agronomic standpoint of disease, pest and fertility management. And Brewin has not yet factored long-term variations in yield and price averages into his economic model.

"We would like to assess if we put a normal range of production and price shocks into the system, which rotations would be the most profitable over the long run or face the least number of loss years," says Brewin.

MANAGING ALL THAT RESIDUE

The residue management component of the Corn Agronomy Project compared four tillage treatments for soybeans following corn — conventional double-disc, high-disturbance vertical tillage, low-disturbance vertical tillage and strip tillage.

There was no significant difference among them in soybean emergence, final plant stand or yield. But an economic analysis showed significant cost and time savings with strip till. Conventional double-discing (requiring two passes) cost just over $32 per acre, whereas strip till cost around $19 an acre.

"For an average size farm in Manitoba (around 1,100 acres) strip till could save a farmer approximately $11,800 to $14,600 per year compared to other tillage systems," says Patrick Walther, a graduate student who performed the economic analysis. "Furthermore, strip till, as a one-pass system, showed time savings on an average farm of 1.1 to 3.7 days compared to vertical till and double disc, respectively."

Strip till could potentially be a better fit with western Canadian no-till practices.

"Strip tillage gives you the best of both worlds because you leave some residue, but you also do tillage where you plan to create a seedbed for your next crop," says Lawley. "One of the reasons that strip till is of growing interest to farmers in Western Canada, is that they can do residue management and band fall or spring fertilizer at the same time."

FERTILITY/TILLAGE COMBINATIONS

Flaten's team did experiments in 2015 and 2016 to compare response to P fertilizer rates and methods of application in corn following wheat in both a strip till and tandem-disc tillage system. Rates were again a control (zero fertilizer), MAP at 27 lbs. P2O5/acre and 54 lbs. P2O5/acre fall deep-banded, plus the same rates spring side-banded at planting.

"The spring side-banded MAP treatment was better than fall deep-banding in terms of greater early-season biomass, advanced maturity, and a reduction in grain moisture," says Rogalsky.

The fall MAP was banded at a depth of about five inches below the seed,

Continued on page 12

Continued from page 11

which is quite a bit lower than most farmers would place it.

"It might have taken the corn seedling longer to reach the deep-banded P than it took to reach the side-band, which was only an inch below and two inches beside the seed so the P band was closer and more precise for the side-banded in the springtime," says Flaten.

"The take-home message is that corn growers in Manitoba have a lot of options for managing corn residue," says Lawley. "We did not find differences in soybean yields between any of our tillage treatments. That's good news in that we can look at tools other than just the double disc. So moving towards vertical tillage where you're able to travel faster and do more shallow incorporation of residue, there's that option. As well, if you're interested in protecting soil from erosion, strip till also yielded the same as the double-disc treatment."

HEAT UNITS VERSUS ACTUAL SEASON LENGTH

Further research is looking at how corn heat units (CHU) ratings compare with actual time to maturity for corn hybrids planted in Western Canada.

Paul Bullock's team from the University of Manitoba evaluated six test sites in Manitoba and two in Alberta over two years, keeping accurate measurements of how the corn developed in different weather conditions. They compared three longer-season hybrids rated at 2550, 2600 and 2700 CHU and two shorter-season ones rated at 2200 and 2300 CHU. All the hybrids needed more heat units than their CHU rating said they needed to reach maturity.

Corn on canola stubble. (Left: 27 lb. P2O5/ac. MAP spring sideband versus control (no P).

PHOTO: MAGDA ROGALSKY

"The actual heat unit requirement for the longer-season hybrids was a little more, but the short-season varieties required a lot more," says Bullock. "That basically confirmed producers' concerns about just going with the CHU rating to select a suitable hybrid for their location."

Bullock then began to look at alternatives that could better quantify the heat requirements.

"We looked at GTI (general thermal index)," says Bullock. "It's hard to make a strong recommendation based on two years of the study, but GTI seemed to be more consistent in terms of how much heat was required from location to location. So, it's hinting that it could be a better type of heat unit than the CHU."

But switching to another heat unit is one thing — knowing how many you can expect on your farm is another.

"For that we use 30 years of data. We've done that for CHU but we haven't done that for GTI," says Bullock. "So if we say we need 1400 GTI, we don't know how many of these heat units we get in a year because that data has not been analyzed. We need to collect more information and try to confirm what might be a better heat unit rating because it would be a significant shift if we said to the industry 'Don't use CHU but use GTI instead.'"

Relative maturity (RM) is another method that seed companies use to rate corn hybrids. It gives a range of the number of days required for a hybrid to reach maturity. Each RM rating is specific to the seed company developing the hybrid and is relative to its own check variety, which is different for each company. Bullock's team analyzed data from corn trials over the last few years to see how reliable and consistent RM ratings are.

"Even between the companies, there is some kind of consistency," says Bullock. "When we took the RM rating for all the different companies and compared it to the CHU rating, there was an even tighter relationship, and again consistency between companies is very high.

"That means producers probably don't need to be too concerned about where they get their seed for their grain corn, because it should be reasonably consistent."

That said, RM may not be any more useful as a guide to assess maturity than CHU. "If we say CHU is not working well, and now we're saying that RM is actually quite correlated to CHU, we just don't see RM as being any better," says Bullock.

COOL NIGHTS AFFECT CHUS

Bullock has also investigated whether the variation in the number of CHUs required could be due to temperature shock caused by the colder summer nights that are more common on the Prairies.

After plotting data from the test plots and looking at the number of hours the corn spent below 4.4 C, researchers found, counterintuitively, that hybrids that experienced more cold nights actually required fewer CHUs from planting to maturity.

"I have no explanation for this," says Bullock. "Is it a plant coping mechanism?

He says climate change may be a factor. The trend has been warming temperatures, and the rate of increase in overnight temperatures is double what it is for daytime highs.

As much as this research seems to be providing as many questions as answers, it does emphasize that producers have a legitimate concern about maturity, and Bullock's advice to growers is not to take a CHU rating as perfect.

Yes, he says, you may know how many average CHUs to expect three years out of four, and the CHU rating on the variety.

"But if it says 2400 CHU on the rating, you know that you may need 200 or 300 CHU more to get that mature according to our research," he says. "And I say may, because it's variable; you might get it with 2400 but you might not. With corn there's always going to be a risk… we're just not there yet."

NEXT STEPS

Lawley says the next step is to build on what the Corn Agronomy Project has provided so far and to further explore the economics and other benefits of corn in an overall crop plan.

"Western Canadian farmers are definitely interested in growing corn, and one of the reasons is they are looking to increase or maintain carbon in their soils and are excited about this source of carbon and the ability to protect the soil, because we've had a lot of soil erosion in the early spring over the past two years," she says.

"There's been a lot of positive interest from our work with strip till in our residue management experiment. We had farmers call us this spring who were interested in trying strip till on their farms, so we've got some preliminary new experiments where we're growing corn in strips, and I think that's an area we'll be moving to next." **CG**

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New in Western hybrids

New hybrids prove that corn is migrating to Western Canada

By Ralph Pearce, CG Production Editor

In Eastern Canada, the saying is "Corn is King." Although the migration of corn westward isn't as brisk as in soybeans, indications still point to continued growth for corn acres. Manitoba seeded 410,000 acres of corn for grain in 2017, an increase of 18.8 per cent, and a record for grain corn seeding in the province.

For 2018, eight seed and trait companies will introduce more than 20 new hybrids, so get ready to do your homework. Seed selection is among the most critical decisions for corn growers anywhere.

(Legend – CHU: crop heat units; RM: relative maturity; BMR: brown mid-rib; NDFd: neutral detergent fibre digestibility)

CROPLAN

1756VT2P/RIB (77 day/2250 CHU): This is an early introduction that features a fixed ear type suited for medium- to high-stand populations in the 2250-CHU regions. It flowers in the mid-range of the maturity set enabling good-quality grain, and is a medium-height plant with very good stalk strength and good stay-green.

2587VT2P/RIB (85 day/2625 CHU): This hybrid performs consistently across varying soil types in the 2625 CHU area, with plant health that provides for late-season intactness. The hybrid has excellent drydown characteristics (open husk) and an 85 RM. This hybrid also has very good drought tolerance.

DEKALB/MONSANTO

DKC26-40RIB (2150 CHU): This VT Double PRO RIB Complete hybrid has a strong disease package and excellent test weight. Its fast drydown helps put this hybrid on the early side of its relative maturity. It has also demonstrated excellent emergence and late-season appearance.

DOW SEEDS

DS79C56 (2300 CHU, 79 RM): The earliest of the new Enlist weed control system hybrids, this is a high-yielding, early-flowering hybrid featuring the new PowerCore trait for broad-spectrum above-ground insect control. It is a flex ear type with deep kernels and good test weight. Solid agronomics include strong stalks and good late-season plant integrity.

TMF81H46 (400 CHU, 81 RM): This new silage-specific hybrid is part of the Enlist weed control system and includes the PowerCore trait. Strong tonnage can be expected from this early hybrid along with excellent NDFd and starch scores. It is well adapted to various soil types and environments, and boasts a solid agronomic package for stalks and roots.

DS81R65 (2400 CHU, 81 RM): This hybrid featuring the PowerCore trait offers consistent-sized ears down the row with good tip fill, fast grain dry-down and good grain quality. Solid agronomics include good drought tolerance and strong stalks and roots. Excellent emergence and early vigour make this hybrid well adapted to early planting.

DS83T15 (2500 CHU, 83 RM): This new hybrid features the PowerCore trait for broad-spectrum above-ground insect pest control and it has very high-yield potential in productive environments. It offers strong emergence and vigour in cool, wet soils and is well adapted for early planting. Solid agronomics include excellent stay-green, and late-season plant intactness and good stalk strength.

BMR90B17 (2600 CHU, 90 RM): Dow Seeds' earliest BMR hybrid features a new line of BMR genetics with SmartStax and Enlist traits. It provides excellent NDFd and delivers very high-quality corn silage. It produces very good forage yields for its maturity, has a solid agronomic package and adapts well to variable plant densities.

BMR90B94 (2600 CHU, 90 RM): This new BMR hybrid has excellent standability and good stress tolerance. Its solid plant agronomics will support high plant densities and narrow row widths. It moves north well.

DUPONT PIONEER

GRAIN CORN

P7227R (2125 CHU): This hybrid is early maturing with excellent grain and silage corn yield potential plus an exceptional drought resistance score. It has average stalk strength, root strength and grain test weight scores along with an average Goss's wilt resistance rating.

P7527AM (2150 CHU: A new early-maturing corn product with Optimum AcreMax technology, this hybrid delivers an integrated refuge for above-ground insect control. Excellent yield potential and drought tolerance along with an average Goss's wilt resistance rating. It also provides average stalk strength, root strength and grain test weight scores.

SILAGE CORN (RECOMMENDED FOR MANITOBA AND SOUTHERN ALBERTA)

P8700AM (2600 CHU): This product with Optimum AcreMax technology, delivers integrated refuge for above-ground insect control. For Western Canada, it is a high-silage yield corn with very good northern blight tolerance and excellent drought resistance. It also has excellent whole plant digestibility scores when feeding to your animals.

ELITE SEEDS

E44H12 R (2100 CHU): This Genuity VT Double Pro RIB Complete is an early hybrid with good seedling vigour. Its early flowering and short relative maturity make it an excellent option for short-season regions. It also has an excellent yield and test weight.

E52V97 R (2450 CHU): This is the Roundup Ready version of E52V92 R. This medium-tall corn has very good stalk and root strength and adapts well to high population, offering a good yield response in all environments. Its test weight is excellent.

E55T37 R (2600 CHU): This is the Roundup Ready version of E55T32 R. This hybrid has good seedling vigour as well as great stay-green in the fall, which makes it a good candidate for either silage or grain corn. It has a fast dry-down and the yield potential is high in high-yielding regions.

Continued on page 16

Continued from page 15

HORIZON SEEDS

HZ 1451/HZ 1452 (2200 CHU, 74 RM): This exciting, very early-flowering hybrid, is a short-stature hybrid that is characterized by its excellent test weight and exceptionally nice grain. HZ 1451 is offered with the new trait platform Agrisure 3120 E-Z Refuge, which offers European corn borer insect protection only and HZ 1452 is offered with the glyphosate-tolerant Agrisure GT trait.

HZ 1686 (2250 CHU, 76RM): This excellent hybrid offers a high yield to moisture ratio. It gives high yield with dry grain, reducing drying costs in the fall with very good in-season plant health and excellent fall stalk strength allowing for an easy harvest.

HZ 1840 (2350 CHU, 78 RM): This new conventional hybrid with huge, girthy ears and great kernel depth offers great characteristics as a potential grain or silage hybrid.

MAIZEX SEEDS

SILAGE CORN

MS 6902R (1950 CHU, 69 RM): This Roundup Ready Corn 2 hybrid with a strong combination of maturity and yield makes this a leading performer for early silage. It has large, girthy ears with soft kernel texture for increased starch availability. A large, robust plant with wide leaves maximizes tonnage and white cobs increase feed palatability.

MS 7420R (2300 CHU, 74 RM): This aggressive Roundup Ready Corn 2 hybrid has strong seedling vigour and large, robust plants. Large ears have kernels with soft texture to increase digestibility. White cobs increase feed palatability.

MS 8088R (2400 CHU, 80 RM): This flexible hybrid with the Agricure GT trait has strong stalks that allow for flexible harvest. Large ears increase starch quantity while its tall, robust plant increases tonnage. Performance excels in low- and high-yield environments.

PRIDE SEEDS

A4477HM (2300 CHU): This new introductory conventional hybrid for silage and high-moisture corn usage, from a unique genetic product family, features slow grain-drying rate that preserves reliable and consistent feed quality at ideal moisture content. Ears are very girthy, exceptionally consistent, producing packed kernels on a white cob. This hybrid has very good Goss's wilt tolerance, outstanding health, standability and disease resistance. **CG**

About the northwest

To this farmer, northwestern Ontario offers loads of advantages over the hustle of the southwest

By Ralph Pearce, CG Production Editor

Whether it's through the longer days of spring and summer in northwestern Ontario or the darker nights that mark the passage of winter, Kim Jo Bliss puts a lot into every hour of every day. A full-time farmer, manager of the Emo Agricultural Research Station, a passionate advocate for farming, and a mentor for young people considering agriculture as a career, Bliss is like many farmers from across Canada — she's busy!

Bliss farms just north of the town of Emo, which sits on the Rainy River between Thunder Bay (four hours to the east) and Winnipeg (three-and-a-half hours west), in what's known as Kingsford Township. There, she operates the family farm that was first worked by W. A. Smith, her great-grandfather and then by Gladys V. Smith, her grandmother, with her two brothers-in-law (Bliss's great-uncles) Bud and Charlie Smith, helping out. Between the three of them, they taught Bliss all she needed to know about raising cows and growing forage crops. Bliss honours her grandmother — Nanny — calling her "a woman in ag" before the designation "Women in Ag" was ever recognized.

"I farmed every day with my grandma: she taught me the love of farming, dogs and hard work… and stubbornness," says Bliss, who's grown the farm to roughly 880 acres workable with more land in the family that needs fencing and ground that needs to be worked to be productive. There are also 50 cows, a dozen sheep and a few ducks that she manages. "I've been farming my whole life — my mom and dad moved into a mobile home in my grandma's yard when I was a baby, and I chose to stay with her many times as my parents would travel with my brother for hockey."

Continued on page 18

Bliss credits her grandmother, Gladys Smith, with instilling the love of farming she carries with her today.

Continued from page 17

Her parents — Tony and Louise Bliss — still help out as much as they can on the farm. Her father loves to drive the tractor, haul manure, plow snow or help with the hay. Her mother also pitches in with some of the chores, including bottle-feeding the lambs, when Bliss is late arriving home from meetings or other functions.

Bliss's boyfriend, Clayton Stang, also provides support and a helping hand whenever needed, understanding her time commitments and demands both on and off the farm.

And then there are her two nieces, Marlee, aged nine and Maddie, who's 11. Bliss hopes they'll follow her lead and fall in love with farming the way she did. She includes them in every aspect of life on the farm and they've been absorbing it all. They've convinced "Auntie Kimmie" to add rabbits and a horse to her menagerie, and they're trying to get her to take on some chickens, as well. Also the two girls take cattle to the local fair, and earlier this year, Maddie joined 4-H.

NORTHERN DIVERSITY

It comes as a surprise to some that northwestern Ontario boasts such a diverse, yet significant land base in which so many operate farms. Bliss has encountered amazement on the part of some people who have never considered the region of Thunder Bay, Emo, Fort Frances and Dryden to have farms of up to 1,000 acres and "more conventional" cropping rotations. She's had a few people ask if they could drop by while they're visiting New Liskeard: she points out that it'll take 12 to 16 hours to "drop by."

To put it in perspective, Bliss notes that in the time it would take her to drive east to Ottawa, she could be almost to the Alberta-B.C. border, heading west.

"I love to talk about our incredible district," says Bliss, adding that it's tough to pinpoint just one "best part" of farming in Ontario's northwest. "Not only is it beautiful, we have producers growing top-yielding corn, soybean and canola — the longer days are enjoyed by soybeans and seed production. We can grow forages, so I'm sure the cow herd will be here always, and we have good cattle that are hardy and do well in a feed lot. Our long days are incredible (during summer) with daylight until 10 p.m., and again at 4:30 a.m., which makes for great working hours."

Kim Jo Bliss, who farms near Emo, Ont., believes there's no better place to farm than northwestern Ontario.

"Not only is it beautiful, we have producers growing top-yielding corn, soybean and canola."

— Kim Jo Bliss, Emo, Ont. producer

Some might say that the other end of the calendar might be dauntingly dark yet Bliss never allows something like daylight to dictate what needs to get done on the farm. She tries to bale-graze new areas of the farm every year during those dark and short days from November through to the end of January. Then she calves her cows in February and March.

Besides, from a cropping perspective, another benefit of living "off the beaten path" is that diseases and pests aren't as common.

Bliss says there has also been a considerable amount of land cleared as well as tile drainage work that has been done, which is increasing the number of crop acres in the area. She estimates that she receives a phone call or an email at least once a week from someone looking for a farm or land.

Some of the callers are younger, she adds, but some are just looking to move to more affordable land. Many are selling theirs for between $10,000 and $20,000 per acre, and are looking at prices in the Rainy River region from $500 to $1,000 per acre — more if it's tiled.

"Many of us have lots of land, yet we haven't always been forced to be more productive, since at one time, it was easy to acquire more land," says Bliss, also noting the younger producers who are moving into the region. "It's very clear that young people have an interest in agriculture, but they also want to work on the farm full time — they don't want to work off the farm — they want the farm to support the family."

Bliss is a huge advocate of agriculture, promoting the variety of career choices the industry holds, and she's participated in every opportunity she's had to engage in that promotion. She serves and volunteers on boards and committees in the Emo area, and is passionate, not just about agriculture, but agriculture in the Rainy River district and northwestern Ontario in general. She's served with the Beef Farmers of Ontario and its advisory council, as well as the Rainy River Cattlemen's Association as its secretary. When she was 12, she joined the Rainy River District 4-H, becoming a leader nine years later, and she continues to spend time with the Leaders program.

Among her other affiliations, she attends meetings and helps out with the Rainy River Soil and Crop Improvement Association and also serves as chair for

PHOTOGRAPHY: FARM AND FOOD CARE ONTARIO

the Riverside Foundation, Emo's local hospital fundraising committee.

Her job with the Emo Agricultural Research Station (EARS) involves cereal, oilseed, forage and biomass research, plus variety trials, fertility trials plus demonstration plots. At one time, the station was operated by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), but was transferred to the University of Guelph's control several years ago.

"We're lacking corn equipment but have grown corn in the past, and this year, are working with a local farmer to plant corn plots here at EARS," says Bliss, who's thankful for the relationships she's forged through the years. "Soybeans and canola are of big interest these days but with large cattle numbers, so are forages. We also answer weed questions, help with soil test results, and there's always someone with some type of question. We've had some great partnerships with industry in our area, and we're lucky to have a lot of great people supporting what we do here in Emo."

STAYING ORGANIZED

With so much to do in a day and during the year, Bliss's biggest challenge is time management. Although the summer days are longer than other parts of Eastern Canada, the season is shorter.

If all goes well in a growing season, that's seldom a problem. But if the weather doesn't co-operate, it becomes a balancing act to manage her own operation while co-ordinating the business of overseeing the plots at EARS, or organizing an open house at the station.

"My most challenging time is haying season — if the weather is great, it helps, but it means very long days," adds Bliss. "I calve my cows in February and March, since that's the slowest time at the research station, and in winter I get to spend more time at home, but I still need to find trials and partnerships for the upcoming season. I could easily work endless hours at EARS, where it's no different than a farm — there's never nothing to do. But I have to disconnect and go home and work."

On a larger scale, Bliss sees the local food movement as a Catch-22 of sorts. On one hand, she believes consumers are recognizing the benefits of local food and appreciating the efforts of farmers in the area. On the other hand, in the Rainy River district, there's an issue with small local abattoirs struggling with higher hydro rates and higher taxes, since they're zoned industrial.

"I believe they need to put something more behind this statement than just talk," says Bliss. "Without local abattoirs, we're unable to feed our local friends and family, and this is a very real problem. I also think there's work to be done on fair pricing; we're pleased that cattle markets are steady, but there is little money being made by the grassroots producer. Farms need to grow so big to be able to make money but then they have to look at hiring help, and this takes away from profits. I'm very excited though that many people are really waking up to the importance of our jobs as farmers." **CG**

A 'bio' that works

Commercial use is still a couple of years away, but this bioherbicide is already raising eyebrows

By Ralph Pearce, CG Production Editor

When it comes to biopesticides, most researchers say that despite today's limited selection of bio-based fungicides, insecticides and herbicides, the technology's potential is extraordinary.

Public and private scientists are especially excited by an "all natural" basis for developing new active ingredients. Since most of the elements for these biopesticides come from natural sources, they point out, resistance is all but ruled out, and concerns about residue limits are also reduced.

That's much of the story behind Phomo macrostoma, a bioherbicidal fungus developed by a research team at Agriculture and Agri-Food Canada (AAFC) in Saskatoon. Last April, AAFC entered into a partnership with Premier Tech to further develop, register and commercialize Phoma macrostoma for a wider farm market.

Currently, Phoma's only registered crop is turf, for broadleaf weed control, including dandelion.

Work on this interaction dates back to 2001, when the effects of the naturally occurring fungus were first seen in dandelion. Subsequent work showed a similar impact on other broadleaf weeds, including Canada thistle and chickweed. The federal government, Western Grains Research Foundation and others have provided funding for the research over a 10-year period, and the studies continue today.

HOW IT WORKS

Phoma interferes with chlorophyll production in susceptible plants, causing bleaching (chlorosis) in the plant tissues, and subsequent death. Among the tested species, dandelion and wild mustard saw the greatest level of control. In initial research, dandelion exhibited 86 per cent photo bleaching and 92 per cent mortality. Wild mustard, a considerable scourge in Western Canada, displayed 61 percent photo bleaching and 61 percent mortality.

That research was published in June 2011 by a team of researchers that included Dr. Karen Bailey with AAFC-Saskatoon. In all, Phoma macrostoma 94-44B, as it's known, was evaluated on 94 plant species, along with target and non-target weeds. Generally, the fungus was pathogenic to dicotyledon plants (legumes and most vegetable crops) but not so with monocots (corn and cereals). Dandelion and wild mustard were two of the weed species tested using Phoma, but there were a total of 29 species and 14 plant families that were assessed to start. Pigweed, common ragweed, perennial sowthistle and lamb's quarters were among the others evaluated, yet all saw lower levels of bleaching and mortality (see Table 1).

Five years later, researchers learned that Phoma produces a biosynthetic metabolite called macrocidin as its active ingredient. Macrocidins inhibit an enzyme called phtyoene desaturase, thereby interfering with photosynthesis and creating the bleaching effect — and then death — in the leaves of susceptible plants.

Dr. Russell Hynes, who works in microbiology, biopesticide research and development with AAFC's Saskatoon Research and Development Centre, is the lead on Phoma macrostoma's work on weed susceptibility. He was also one of the authors for subsequent study results published in 2015 and 2016, helping define macrocidin's effects. He notes that Phoma is being developed for use in organic and conventional farming practices, and that work continues on other crops, without any preference for east or west cropping systems.

"Several farmers have told me that no herbicide is perfect, and most farmers I speak with want to reduce synthetic chemical inputs to their land," says Hynes, who is also adjunct professor in food and bioproducts sciences at the University of Saskatchewan. "However, I know that every farmer's bottom line is cash return on the product they use: Phoma will not be the product for some farmers, and that's a fact."

In 2015 and 2016, Phoma was field-tested by an organic grower from Radville, Sask., who determined the efficacy on his farm to be roughly 80 per cent control on Canada thistle and 90 per cent on wild mustard. In the 2011 study,

bleaching on Canada thistle was 40 per cent with a 74 per cent mortality rate, (the application rate was four times the normal standard). Dandelion meanwhile, has become one of the harder-to-control weed species in winter wheat production in Eastern Canada.

"We've tested Phoma on corn (not susceptible), potatoes (not susceptible) and soybean — which appears to be not susceptible, but testing in Eastern Canada is needed," says Hynes.

A LONG WAY TO GO

For all of the promise, there is still the long road to registration and commercialization of the product, beyond its current usage in turf. That's where Premier Tech has stepped in to take things to the next level. Marc Béland, the company's market development director, acknowledges several factors influence Phoma's evolution. First is the production stage, to bring it to a broader scale for use in agriculture.

"But there's also the whole scale-up of production and formulation to bring a product to market that's registered for agricultural use," says Béland, who's had numerous calls from growers concerning its capabilities and availability. "Where we stand right now is that Phoma has a huge potential to bring new tools to agriculture."

Yet the challenges of registering and industrial-scale production are hard to overcome. Béland notes Premier Tech is setting its sights on 2020 for having a product registered for use on a broader cropping scale.

The good news is that Premier Tech is targeting a launch across Canada, as opposed to one half of the country versus the other. Béland concedes that given its Western Canada base for development, the logical assumption would be that producers there could expect to see it first. But that's not the case.

Work will continue to determine its use in more eastern-oriented cropping systems, including corn and soybeans. Yet with crops such as alfalfa, more caution towards sensitivities will be needed.

"For agriculture, it would be best for both sides of the country," says Béland, agreeing that there may be more of an immediate fit for Western Canada. "A good proportion of the interest I've been getting is from organic producers, who are pretty limited in what they can use to control weeds, so they see a lot of potential with Phoma.

"Most farmers I speak with want to reduce synthetic chemical inputs to their land."

— Dr. Russell Hynes, AAFC-Saskatoon and University of Saskatchewan

TABLE 1. PERCENTAGE OF PHOTO-BLEACHING AND MORTALITY FROM PHOMA MACROSTOMA IN COMMONLY FOUND WEED SPECIES

Common weed name	Photo-bleaching %	Mortality %
Pigweed	3	10
Common ragweed	0	62
Perennial sowthistle	100	33
Dandelion	86	92
Wild mustard	61	61
Common chickweed	15	68
Lamb's quarters	0	30

Source: The effects of Phoma macrostoma on nontarget plant and target weed species. Dr. K.L Bailey (AAFC-Saskatoon) et al, June 2011.

Mortality rates in dandelion and perennial sowthistle using Phoma macrostoma are encouraging, yet there is almost no control with pigweed, common ragweed and lamb's quarters (all species listed in this table had the 1x standard rate applied).

RESISTANCE IS DIFFICULT

One of the advantages for bioproducts such as Phoma is their ability to fend off resistance. Two years ago, a panel discussion titled, "A new paradigm for biotech in ag" was held in St. Louis, Missouri. Although the focus was on bio-based biotech research and development, the discussion included references to the similarities between biotech applications based on naturally occurring agents and those within the biopesticide sector. At the time, biopesticides were worth between $2 billion and $3 billion, compared to the chemical pesticide market's $55 billion to $60 billion value. But the biopesticide growth rate was 15 to 16 per cent in 2015, while the chemical sector's was in the single-digit realm.

The limited potential for the development of biopesticides may be another important factor in their development. Microbes, enzymes or other biochemical structures often affect more than one point or pathway in a plant. They are also biodegradable, and this "natural" ability means they don't exist long enough for resistance to develop.

"Phoma affects multiple points in the metabolic machinery of the targeted weed species," says Hynes. "I'd suggest that resistance will take a very long time to develop. Phoma or macrocidin residue a year later is not detectable, so Phoma-sensitive crops can be seeded."

Another advantage of using biopesticides is that they can actually lengthen the life of currently existing herbicides, fungicides, insecticides, as well as biotech applications such as Bt corn hybrids or glyphosate-resistant technologies.

"Based on my research in the soil types I've tested, broadleaved crop response to Phoma in different soil or climatic zones may vary somewhat," states Hynes. "I'm currently examining dose application and application timing, including crop seeding and the weed cotyledon and first true leaves stages." **CG**

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